

UNITED STATES PATENT OFFICE.

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TELEPHONE SYSTEM.

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To all whom it may concern:

Be it known that I, GEORGE A. YANOWSKI, a citizen of the United States of America, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Telephone Systems, of which the following is a specification.

My invention relates to telephone systems and has to do more particularly with party line telephone systems in which means is provided for permitting one subscriber to obtain connection with another subscriber on the same line.

In prior party line telephone systems of the abovementioned type, and of the type disclosed in Patent No. 1,202,367, issued to H. D. Currier, the operator in testing the jack of the called line operates means in the cord circuit to transmit a revertive audible tone test to the operator to appraise her of the fact that the called substation is a substation on the calling line. When this condition arises, the operator asks the subscriber calling to replace his receiver so that the called party may be signalled. To signal the called party, the operator withdraws the answering plug from the jack of the calling line and inserts the calling plug into the jack of the calling line and depresses the proper ringing key plunger to connect a generator of the desired frequency to operate the call bell of the called party, and then depresses a ringing key plunger to connect a generator of the desired frequency to operate the call bell of the calling line. The calling subscriber, after hearing his call bell operated, removes his receiver from the switch hook and waits for the called party to answer. If the called subscriber does not answer immediately the calling subscriber winks his switch hook, which causes a supervisory signal to flash, and the operator again goes through the same details of depressing the ringing plungers to signal the calling and called subscribers. This method of procedure uses up a considerable amount of the operator's time and is also more or less confusing, so that should revertive calls happen frequently during a rush hour the efficiency of the operator is lessened and the number of calls she may answer is reduced due to this added attention which she must give to revertive calls. This method is also unsatisfactory in

that the called subscriber's bell is not rung intermittently until he responds.

An object of my invention is to provide a circuit arrangement which overcomes the above-mentioned difficulties and which includes a novel circuit arrangement for ringing the calling and the called subscriber's bells alternately until the called subscriber answers. I provide a very simple arrangement to accomplish this feature which includes only four relays and a pair of plugs and which takes the place of the regular cord circuit and releases the regular cord circuit for use in establishing other connections. A sufficient number of these circuits is provided to take care of the maximum number of revertive calls that an operator is liable to handle. One of the plugs of my circuit is adapted to be inserted into a jack of the polystation line while the other plug is for insertion in one of a plurality of jacks, which jack is associated with a combination of generators and constantly rotating interrupters to alternately ring the calling and called parties' call bells. When the circuit of my invention is connected as just described, no further attention is given to this connection by the operator until she receives a disconnect signal notifying her that the connection has terminated. Other features, as well as the above, will be more fully herein-after described.

For a better understanding of my invention, reference may be had to the accompanying drawing in which the preferred form of my invention is illustrated. To the left of the drawing, I show a party or polystation line consisting of substations A, B, C and D, equipped with harmonic signal bells, the said party line being connected by means of the line conductors 1 and 2 to the exchange. The line conductors 1 and 2 terminate at the exchange in line circuit equipment L, comprising the usual line relay LR, line signal S, cut-off relay CO and the multiple jacks J.

The signalling or connecting circuit E, which is used for connecting a party line, to which the calling and called substations are connected, with the necessary signalling apparatus to ring the call bells of the respective substations, comprises a pair of plugs P and P' and four relays. A sleeve relay SL is provided which is actuated when the plug P is inserted in the jack of the party line, and

a supervisory lamp SS is provided which is lighted upon the actuation of the relay SL, the said lamp remaining lighted until the subscribers answer. A listening key LK is provided which, when actuated, connects the operator's set O to the tip and ring conductors of the plug P for the usual listening purposes. A ringing control relay RC is provided which is actuated upon the energization of the sleeve relay SL to control the application of ringing current to the party line, as will be more fully hereinafter described. A supervisory relay SR is provided which is adapted to be energized over the subscriber's line and which controls the supervisory signal SS. A ringing trip relay RT is provided and is energized when one of the subscribers answers to open the circuit of the ringing control relay RC to prevent further application of ringing current to the line. The plug P' is adapted to connect with any one of a plurality of jacks J', J², J³, J⁴, J⁵ or J⁶, for purposes that will be presently described. The substations A, B, C and D of the party line are provided with tuned signal bells which respond to different frequencies of current, as is well known. To the left of the drawing, I show a plurality of interrupters I, I', I², I³, I⁴ and I⁵, the interrupters being connected to the jacks J', J², J³, J⁴, J⁵ and J⁶. Each jack is connected to two different ringing generators. I thus provide six jacks, thereby providing six different combinations of the four different ringing current generators. As many jacks as are necessary to take care of traffic are provided. Each interrupter I, etc., is provided with three sets of brushes, and by describing the interrupter I, a further description of the others is not thought necessary. The interrupter I is adapted to sequentially close connections between brushes 3—4, 5—6, 7—8, 3—4, etc. The brushes 3 and 4 are adapted to connect 16 cycle ringing current to the jack J'; the brushes 5 and 6 are adapted to connect 33 cycle ringing current to the jack J'; and the brushes 7 and 8 to connect ground to the said jack. As the shaft of the interrupter I is constantly rotating, the 33 cycle current is first connected for a predetermined period to the jack, then disconnected; and for a short period nothing is connected to the jack; then the 16 cycle current is connected for a predetermined period, then disconnected; and ground is then connected to the jack for a predetermined period. The interrupter I is connected to the 16 and 33 cycle current; interrupter I', to the 16 and 50 cycle current; I², to the 16 and 66 cycle current; I³, to the 33 and 50 cycle current; I⁴, to the 33 and 66 cycle current; and I⁵ to the 50 and 66 cycle current, so that subscribers A and B, A and C, A and D, B and C, B and D, and C and D may be signalled by inserting the plug

P into the jack of the party line and the plug P' into one of the jacks J', J², etc., depending upon which two subscribers upon the party line wish to converse with each other. Generators G, G', G² and G³ are provided for supplying the different frequencies of current.

Having described in general the apparatus embodying my invention, I will now describe in detail the operation of the circuit as illustrated in the accompanying drawing.

By referring to the above patent, the operation of a revertive call may be traced, and when the operator tests the multiple jack of the called line by placing the tip of the calling plug to the sleeve of the jack of the called line, should the called subscriber be on the same party line as the calling subscriber, the operator will receive a distinctive tone, known as a revertive tone, as described in the above-named patent. The operator first inquires the number of the calling substation, advises the calling party to hang up his receiver, and then withdraws the answering plug of the cord circuit from the jack J of the party line. Assuming now that it is the subscriber at the party line substation A that wishes to converse with the subscriber at the party line substation B, and, further, that the bells of the respective substations are tuned to respond to 16 and 33 cycle current, respectively, the operator inserts the plug P of the circuit E into the jack J of the party line, upon which the subscribers A and B are located; and the plug P', into the jack J' which is associated with the 16 and 33 cycle ringing generators. The plug P having been inserted into the jack J, a series circuit is established for the cut-off relay CO of the line circuit L and the sleeve relay SL of the circuit E, which may be traced from battery through the winding of the said sleeve relay SL, sleeve contacts of the connected plug P and jack J, through the winding of the cut-off relay CO to ground. The closing of alternate contact 9 of the sleeve relay SL establishes an energizing circuit for the ringing control relay RC, traced from battery through alternate contact 9 of relay SL, conductor 10, normal contact 11 of the listening key LK, conductor 12, through the winding of the relay RC, and over conductor 13, to ground at normal contact 14 of the ringing trip relay RT. The closing of alternate contact 9 of the relay SL also closes an energizing circuit for the supervisory lamp SS, traced from battery through alternate contact 9 of relay SL, conductor 15, through the lamp SS, and conductor 16 to ground at normal contact 17 of the supervisory relay SR. The interrupter I rotating connects 33 cycle ringing current from the ungrounded pole of the generator G', over conductor 18, conductor 19, through

brush 5, conductive segments 20 and 21, brush 6, tip contacts of the connected jack J' and plug P', through winding 22 of the ringing trip relay RT, conductor 23, alternate contact 24 of the ringing control relay RC, conductor 25, tip contacts of the connected plug P and jack J, over the poly-station line and through the bells at the substations, then back through the ring contacts of the connected jack J and plug P, over conductor 26, through alternate contact 27 of the relay RC, and through resistance 28 to battery and ground. The call bell at the called substation B is operated for a predetermined period until the insulated segments 29 and 30 engage the brushes 5 and 6. When in this position, the brushes 3 and 4 engage the conductive segments 31 and 32, connecting signaling current from the generator G over conductors 33 and 34, through brush 3, segments 31 and 32, brush 4, tip contacts of the jack J' and plug P', through the winding 22 of the relay RT, over the previously traced path, through the call bell and condenser of the substation A, back to battery and ground at alternate contact 27 of relay RC to ground. The call bell of substation A is now actuated for a period of time until the brushes 3 and 4 engage the insulated segments 35 and 36, respectively.

A short period of time elapses after generator G' is disconnected from the line before generator G is connected to the line. As the interrupter continues its travel, the brushes 7 and 8 engage respectively the conductive segments 37 and 38 to connect ground through the winding 22 of the relay RT during the silent period of the ringing so that should the subscriber answer during this period the relay RT will be energized, as will presently be described. The interrupter I continuing its rotation again starts its cycle of rings so that the 33 cycle current is connected for a period and then disconnected for a period; then the 16 cycle current is connected for a period and then disconnected for a period. Thus, the called subscriber is signalled and then the calling subscriber is signalled, with a silent period between the signals, and this sequence is carried on due to the constantly rotating interrupter I until one of the subscribers answers.

The calling subscriber after replacing his receiver waits to hear his bell ring and knows that as long as his bell is rung intermittently the called subscriber's bell is also being rung intermittently, and that as soon as his bell stops ringing he should answer as the called subscriber has already answered. The relay RT remains at normal during the ringing of the subscribers, and should either of the subscribers remove his receiver during a ring-

ing period the operation of the switch hook contacts opens the bridge across the line circuit including the condenser and call bell and permits a flow of battery current through the winding 22 of the relay RT, thereby bringing about the actuation of the relay RT. This circuit may be traced from ground through either the generator G or G', as the case may be, the tip contacts of the plug P' and jack J', winding 22 of relay RT, conductor 23, alternate contact 24, conductor 25, tip contacts of the connected plug and jack P and J, through the now closed contacts of the substation switch hook at the substation A or B, as the case may be, back through the ring contacts of the plug P and jack J, and over conductor 26, to battery through alternate contact 27 and resistance 28. The relay RT, upon energizing, closes its alternate contact 40, establishing a locking circuit for itself, traced from ground through winding 41 of relay RT, its alternate contact 40, conductor 42, and normal contact 43 of re-ring key RE to battery and ground at alternate contact 9 of relay SL. The relay RT responds to battery current only, and not to ringing current. The opening of normal contact 14 of relay RT opens the circuit of the ringing control relay RC, and the opening of alternate contacts 24 and 27 of said relay prevents further applications of ringing current to the line.

The closing of normal contacts 24 and 27 of relay RC closes an energizing circuit for the supervisory relay SR, traced from battery through the lower winding of said relay SR, normal contact 27 of relay RC, conductor 26, ring contacts of the connected plug P and jack J, the now closed contact of the substation switch hook, back through tip contacts of the connected jack J and plug P, conductor 25, normal contact 24, and through the upper winding of the relay SR to ground. The opening of normal contact 17 of supervisory relay SR opens the energizing circuit of the supervisory lamp SS, notifying the operator that the subscribers are now in conversational circuit. Had the called subscriber failed to respond, the removal of the receiver at the calling substation and the operation of the switch hook flashes the supervisory lamp to notify the operator to take down the connection. With the circuit of my invention, the operator has only to insert the plugs P and P' into their respective jacks, and the calling and called subscribers are signalled automatically without further attention from the operator. When the subscribers have finished, they replace their receivers upon their respective switch hooks, opening the circuit of the supervisory relay SR at their switch hook contacts, and the relay in restoring closes its normal contact 17, again closing

a circuit for the supervisory lamp SS. The operator noting the lighted signal SS knows that the subscribers have finished conversation and withdraws the plugs P and P' from their respective jacks, and the withdrawal of the plug P from the jack J opens the series circuit of the cut-off relay CO and the sleeve relay SL of the circuit E. The sleeve relay SL restoring opens its alternate contact 9, allowing relay RT to restore, and the opening of the contact 9 effaces the signal SS, rendering the circuit E available for establishing other connections.

Should either subscriber A or B answer during a silent period, the relay RT would energize over a circuit traced from ground at brush 7, through conductor segments 38 and 37, brush 8, tip contacts of the plug P' and jack J', through the winding 22 of relay RT, conductor 23, alternate contact 24, conductor 25, tip contacts of the plug and jack P and J, through the now closed contacts of the substation switch hook of the subscribers A or B, as the case may be, back through the ring contacts of the plug and jack P and J, conductor 26, to battery and ground at alternate contact 27. Relay RT opens the circuit of relay RC and also closes a locking circuit for itself, and the rest of the operation of the circuit is the same as previously described. Should either the calling or called subscriber of the party line wish to converse with another party on the same line, the flashing of the switch hook at the substation will flash the supervisory signal in the usual manner, and the operator in response to the signal actuates her listening key LK to connect her operator's set O to the conductors 25 and 26 so that she may converse with the subscriber. Assuming that the subscriber A wishes to talk to the subscriber D, the operator removes the plug P' from the jack J' and inserts it into the jack J³, which will cause 16 cycle and 66 cycle ringing current to be delivered. The operator then actuates the re-ring key RE to open normal contact 43 to open the locking circuit of the ringing trip relay RT. The interrupter I² rotating connects the 16 and 66 cycle of ringing current from the generator G and G³ in a manner similar to that previously described to signal both the calling and the called subscribers, and the operation of the circuit E is the same as already described.

While I have illustrated my invention operating in connection with certain circuit arrangements, it is to be understood that changes and modifications will readily suggest themselves to those skilled in the art, and I, therefore, do not wish to be limited to the exact arrangement shown, but aim to cover all such changes and modifications as come within the spirit and scope of the appended claims.

What I claim as new and desire to secure by United States Letters Patent is:

1. A telephone system including a polystation telephone line terminating in the central exchange in a jack, a manually controlled operator's circuit provided with a plug for connection to said jack and line, automatic means associated with said circuit for alternately signaling two of the substations connected to said line, and operator-controlled means for connecting said automatic means to said telephone line and for selecting the automatic means to signal said two substations.

2. A telephone system including a polystation telephone line terminating in the central office in a spring jack, an operator controlled circuit provided with a plug terminal for connection to said jack and line, a plurality of sources of ringing current of different characters, operator controlled means for associating said circuit with two of said sources of current, and automatic means for connecting said last mentioned sources of current to said polystation line to signal a calling and a called substation upon said line.

3. A telephone system including a polystation telephone line terminating in the central office in a spring jack, a plurality of sources of ringing current, an operator controlled circuit provided with a pair of plug terminals, one of the plug terminals of said circuit being adapted to be connected to said polystation telephone line, and the other plug terminal being adapted to be associated with the two of said sources of ringing current selected by the operator, and automatic means for connecting said last mentioned sources of current to said telephone line to alternately signal two of the substations thereon.

4. A telephone system including a polystation telephone line terminating in the central exchange in a spring jack, a plurality of sources of signaling current, a manually controlled connecting circuit provided with a pair of operator controlled terminals, operator-controlled means for connecting one of said terminals to said jack and line and for associating the other of said terminals with two of said sources of current, automatic means for applying the current from said sources of current to said polystation line to signal a plurality of substations thereon, and operator-controlled key means for interrupting the application of ringing current to said line.

5. A telephone system including a polystation telephone line, an operator controlled circuit provided with a terminal for connection to said line, a plurality of sources of ringing current of different characters, operator controlled means for associating said circuit with two of the sources of ringing

current, automatic means for connecting said last mentioned sources of current to said polystation line to signal a calling and a called substation upon said line, and a supervisory apparatus for said circuit controlled over the telephone line for signaling the operator when one of said subscribers removes his receiver.

6. A telephone system including a polystation telephone line terminating in the central exchange in a spring jack, a plurality of sources of signaling current, a manually controlled operator's connecting link for associating a selected pair of said sources of current with said polystation line, interrupter means for alternately and intermittently connecting the said selected sources of current to said polystation line for signaling two of the substations upon said line, means controlled from a substation on said line for preventing further application of signaling current to said line, and supervisory means for said circuit controllable over said polystation line.

7. A manually operated telephone system including a subscriber's telephone line, a plurality of sources of signaling current, an operator's connecting circuit having manually controlled terminals for connecting two of said sources of current to said telephone line, and means associated with said operator controlled circuit for disconnecting the current from said line and for preventing further applications of current from either of said sources to said telephone line, said means being controlled over said subscriber's telephone line.

8. A telephone system including a polystation telephone line terminating in the central exchange in a spring jack, a plurality of sources of ringing current, a manually controlled operator's link circuit for associating said sources of current with said line, automatic means responsive to the connection of said link circuit with said line to alternately connect said sources of current to said line, and subscriber-controlled means for disconnecting said sources of current from said line during either ringing interval.

9. A telephone system including a subscriber's telephone line terminating in a spring jack at the central exchange, a plurality of sources of signaling current, a manually controlled operator's link circuit for connecting both of said sources of current to said telephone line, means associated with said operator controlled circuit for disconnecting current from said line and for preventing further applications of current from either of said sources to said telephone line, said means being controlled over said subscriber's telephone line, and a supervisory device controlled by said last means.

10. A manually operated telephone sys-

tem including a subscriber's telephone line, a plurality of sources of signaling current, an operator's connecting circuit having manually controllable terminals for connecting two of said sources of current to said telephone line, a relay in said circuit through which current is applied to said line, and means controlled by said relay for disconnecting said source of current from said line.

11. A manually operated telephone system including a polystation telephone line, a plurality of sources of signaling current, a switchboard operator controlled connecting link circuit having a pair of manually controlled terminals for associating a selected pair of said sources of current with said polystation line, interrupter means for alternately and intermittently connecting the said selected sources of current to said polystation line, and means controlled over said polystation line for disconnecting said sources of current from said line when a subscriber responds either during a ringing interval or a silent interval.

12. A telephone system including a polystation telephone line, a plurality of sources of ringing current, a manually controlled operator's link circuit for associating said sources of current with said line, automatic means responsive to the connection of said link circuit with said line to alternately connect said sources of current with said line, subscriber controlled means for disconnecting the current from said line and for preventing further application of ringing current to said line, and a supervisory signal for said link circuit.

13. A telephone system including a polystation telephone line terminating in a spring jack, a plurality of sources of signaling current terminating in spring jacks, an operator controlled connecting link circuit for associating a selected pair of said sources of current with said polystation line via said first spring jack and one of said second spring jacks, interrupter means for alternately and intermittently connecting the said selected sources of current to said polystation line for signaling two of the substations upon said line, and means controlled from a substation on said line for disconnecting said sources of current from said line when a subscriber responds during a ringing interval and for preventing a further application of ringing current when the subscriber responds during a silent interval.

14. A telephone system including a polystation subscriber's telephone line terminating at the exchange in a spring jack, a plurality of sources of signaling current, an operator's circuit provided with a pair of manually-controlled terminals for connecting two of said sources of signaling current to

said telephone line, automatic means for alternately supplying current from said sources of current to said line to alternately operate the call bells at two of the substations on said line, and automatic means controllable over said line for disconnecting said sources of current from said line when a subscriber responds during either ringing period.

15. A telephone system including a subscriber's telephone line terminating in a spring jack at the exchange, a plurality of sources of signaling current terminating in spring jacks at the exchange, means for associating said line with two of said sources of current via said first spring jack and one of said second spring jacks, automatic means for alternately connecting said two sources of current to said line, and subscriber-controlled means immediately operable when a subscriber responds to disconnect said sources of current from said line.

16. A telephone system including a subscriber's telephone line terminating in a spring jack at a manually operated exchange, a plurality of sources of signaling current terminating in spring jacks, means for associating said line with two of said sources of current via said first spring jack and one of said second spring jacks, automatic means for alternately connecting said two sources of current to said line, and subscriber-controlled means operable when either of said sources of current is connected to said line for immediately disconnecting the said sources of current from said line.

17. A telephone system including a party line, a plurality of ringing generators for supplying ringing current of different characters, an operator-controlled circuit for associating said party line with two of said generators, means for alternately supplying current from said selected generators to said line, a relay through which the ringing current is connected to said line, and means responsive to the operation of said relay for disconnecting the two generators from said line.

18. A telephone system including a party line, a plurality of ringing generators for supplying ringing current of different characters, an operator-controlled circuit for associating said party line with two of said generators, means for alternately supplying current from said selected generators to said line, a relay through which the ringing current is connected to said line, means responsive to the operation of said relay for disconnecting two generators from said line, a locking winding for said relay, and operator-controlled means for opening the circuit of said locking winding.

19. A telephone system including a polystation telephone line, a plurality of sources of signaling current, an operator-controlled connecting link for associating a selected pair of said sources of current with said polystation line, interrupter means for alternately and intermittently connecting the said selected sources of current to said polystation line, a relay through the winding of which the ringing current is connected to said polystation line, and subscriber-controlled means for actuating said relay.

20. A telephone system including a polystation telephone line terminating in a spring jack at the central exchange, a plurality of sources of ringing current, an operator-controlled link circuit provided with a pair of manually-controlled terminals for connecting said line with two of said sources of current, a key for said circuit for connecting the operator's telephone set to said line, a relay for said link circuit responsive to a control exercised at any of the substations on said line, a second relay controlled by said first relay, said second relay being adapted to disconnect the ringing current from the said line and to connect talking current thereto, and an auxiliary contact for said key in the circuit of said second relay.

Signed by me at Chicago, in the county of Cook and State of Illinois, this 3d day of August, 1918.

GEORGE A. YANOCHOWSKI.